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(54) **REFRIGERATOR AND METHOD OF MANUFACTURING INNER DOOR THEREOF**

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F25D 23/02 (2006.01)

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CPC ***F25D 23/025*** (2013.01); ***F25D 23/02*** (2013.01); *F25D 2323/021* (2013.01)

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USPC 312/321.5, 405.1, 405, 326, 329, 291, 312/292; 52/455–457, 800.1, 52/80.11–800.13, 800.15–800.18, 52/800.11–800.13; 62/448, 449
See application file for complete search history.

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(57) **ABSTRACT**

A refrigerator including a storage compartment, an inner door having an opening in a size corresponding to the storage compartment, a plurality of door guards provided at the opening, and an outer door to open/close the opening, the refrigerator further including a plurality of reinforcing members to prevent the inner door having the opening from being distorted.

18 Claims, 15 Drawing Sheets

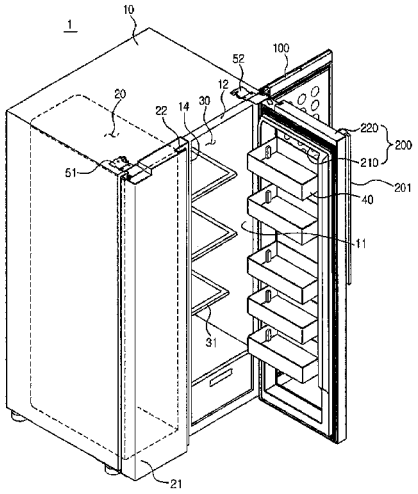


FIG. 1

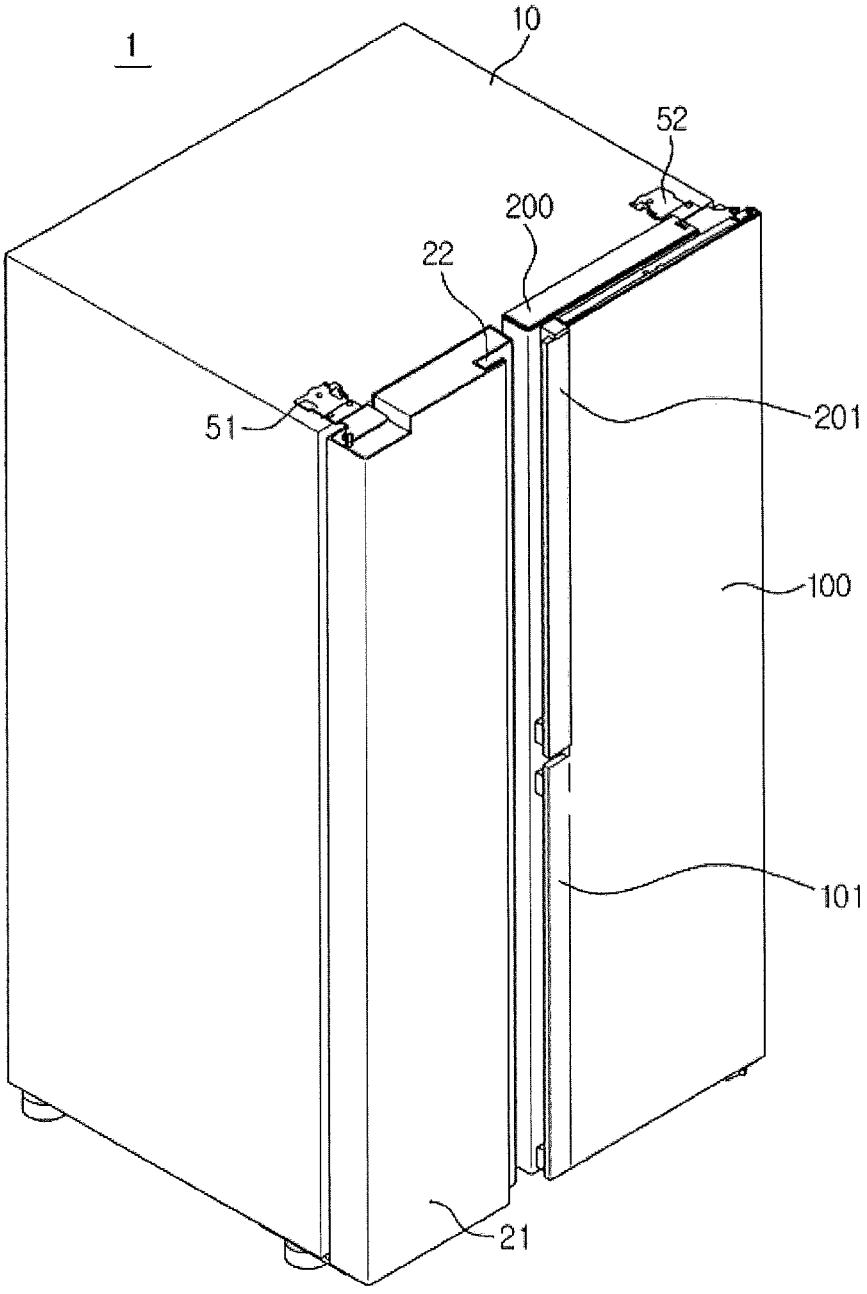


FIG. 2

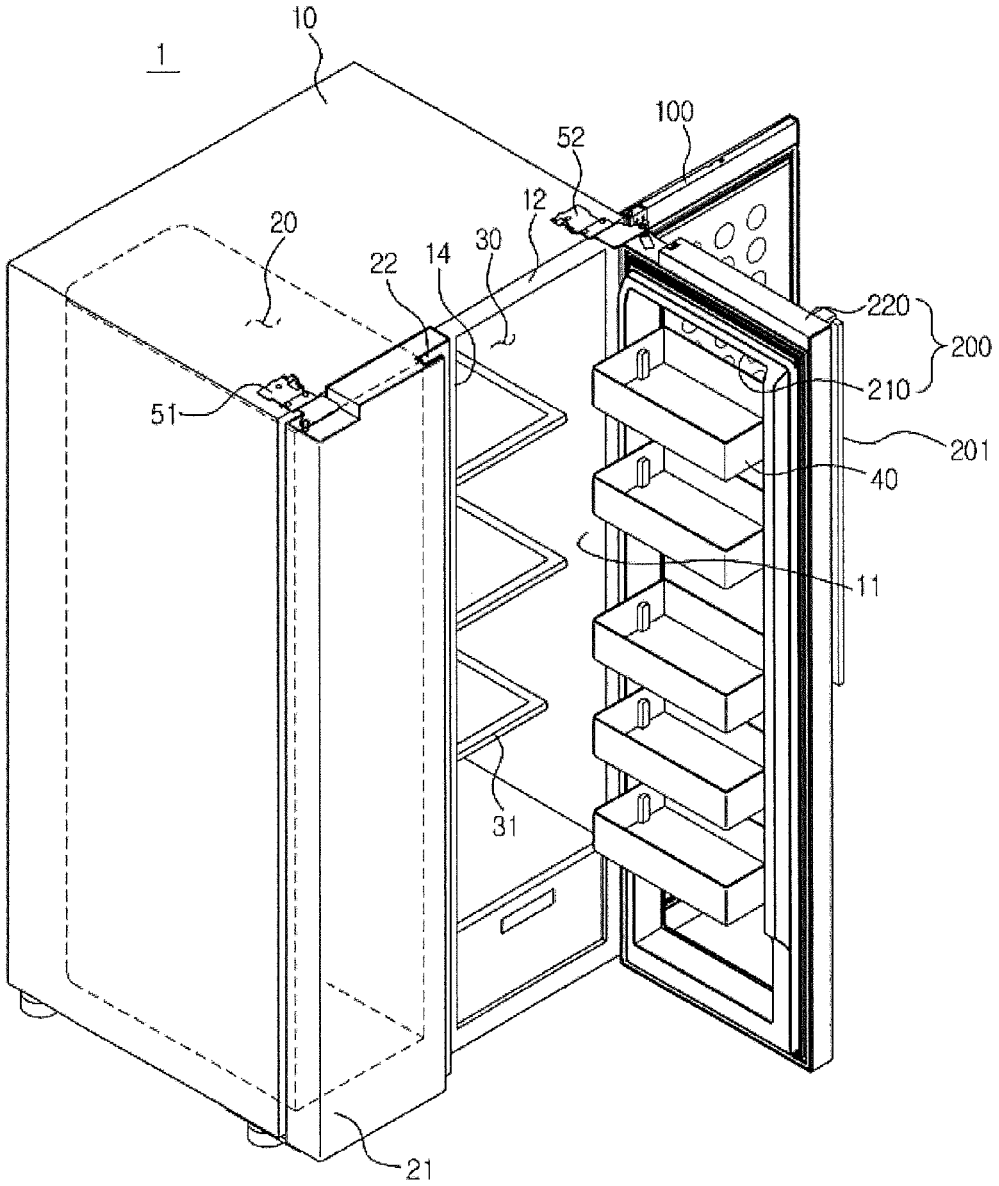


FIG. 3

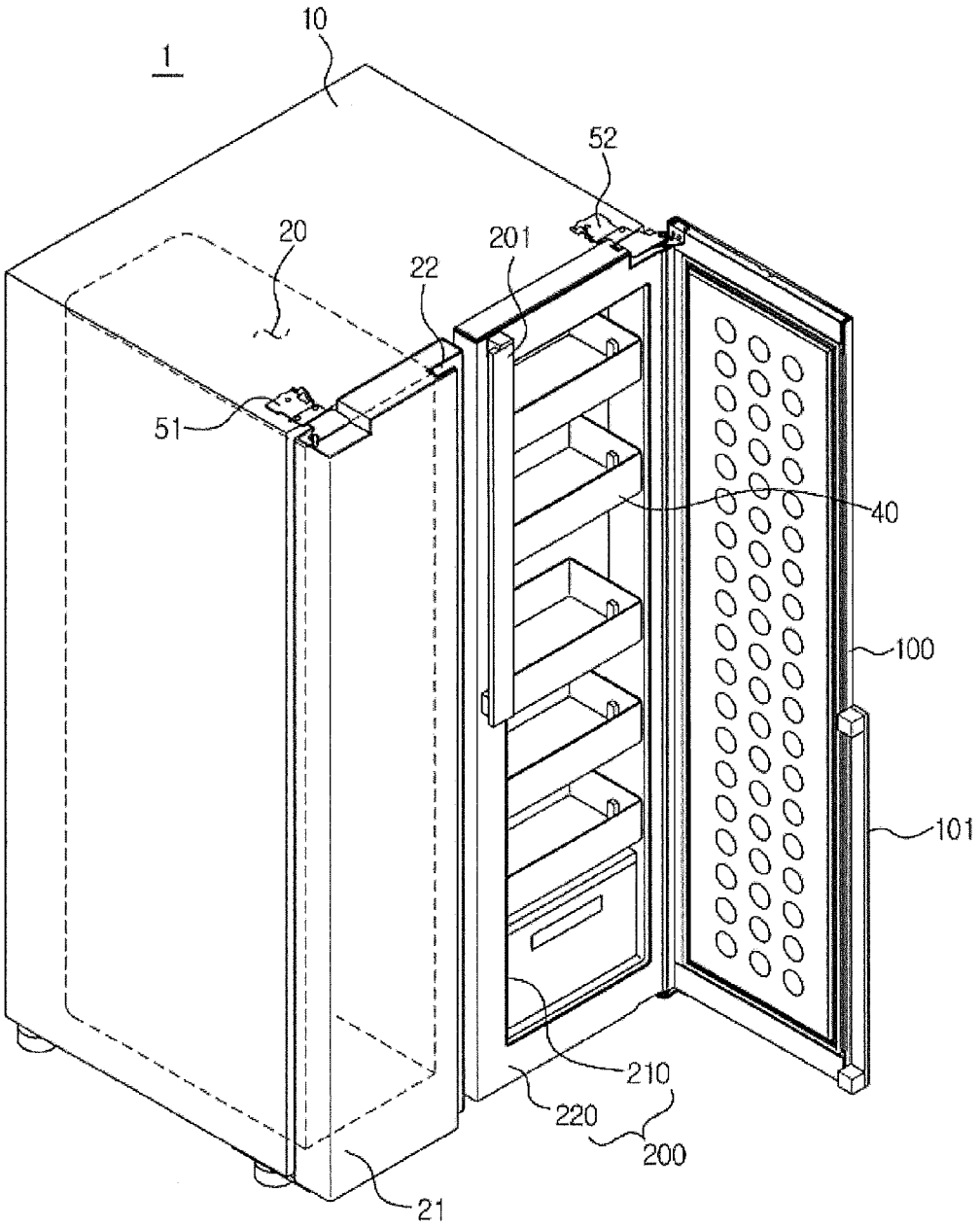


FIG. 4

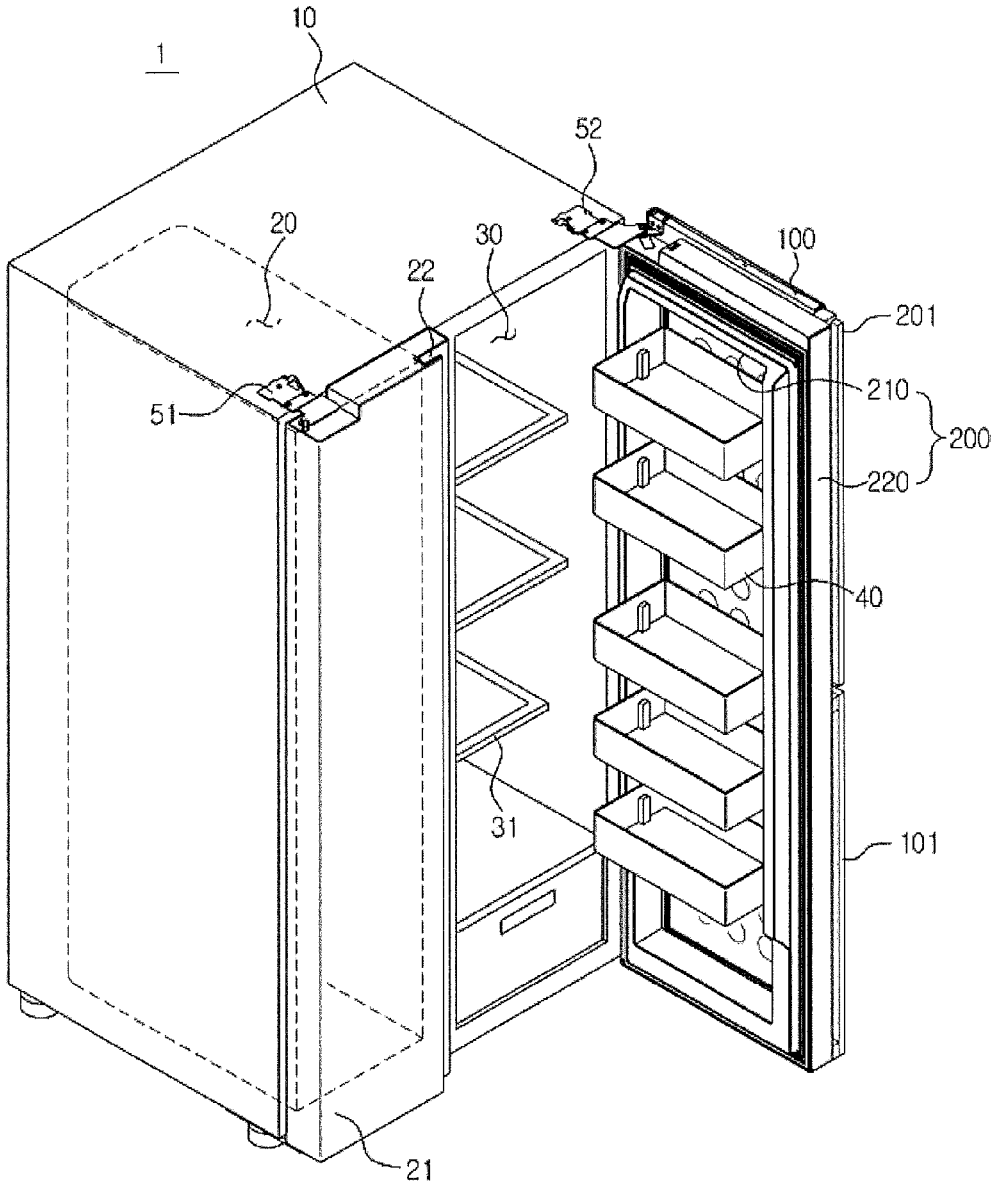


FIG. 5

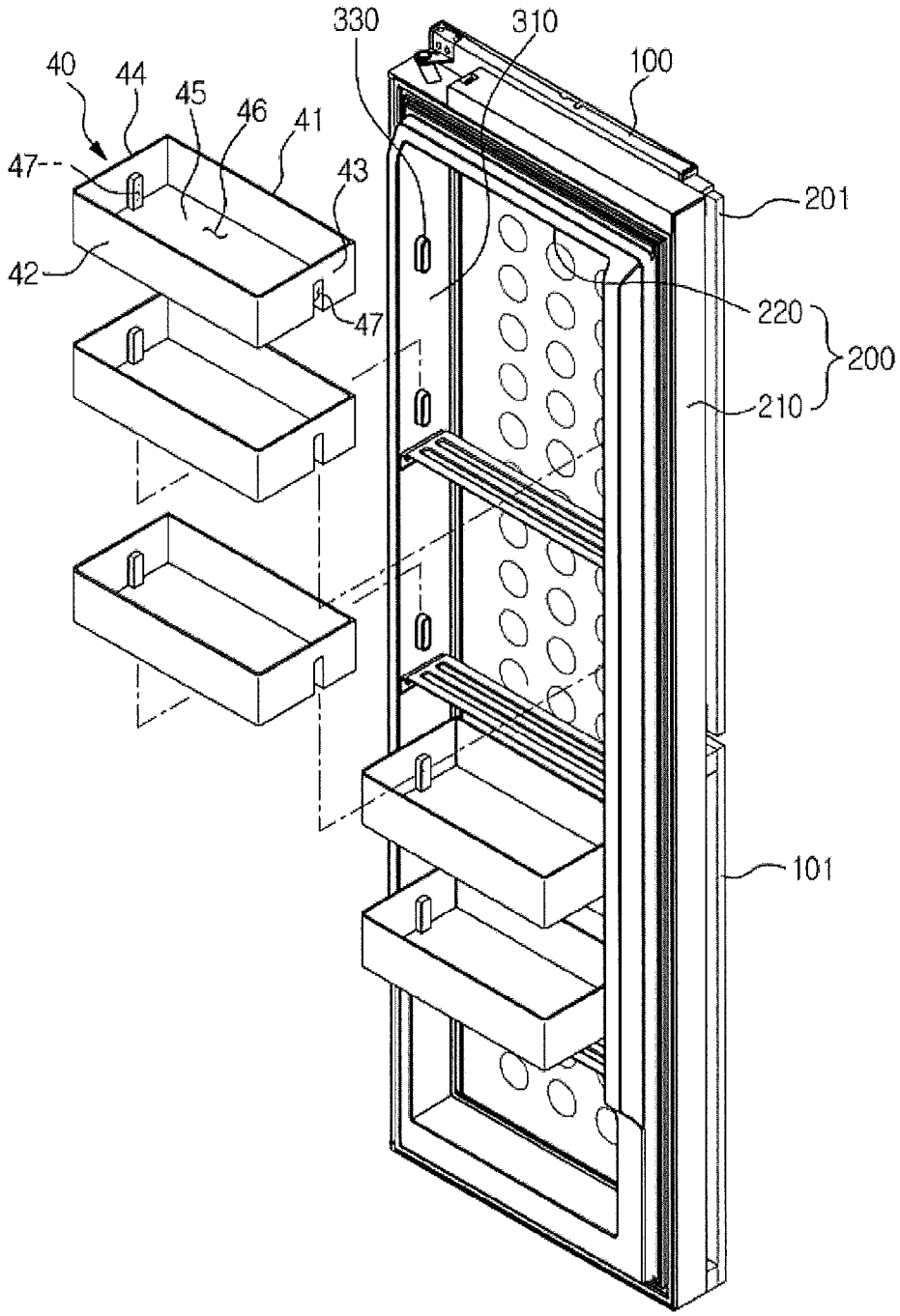
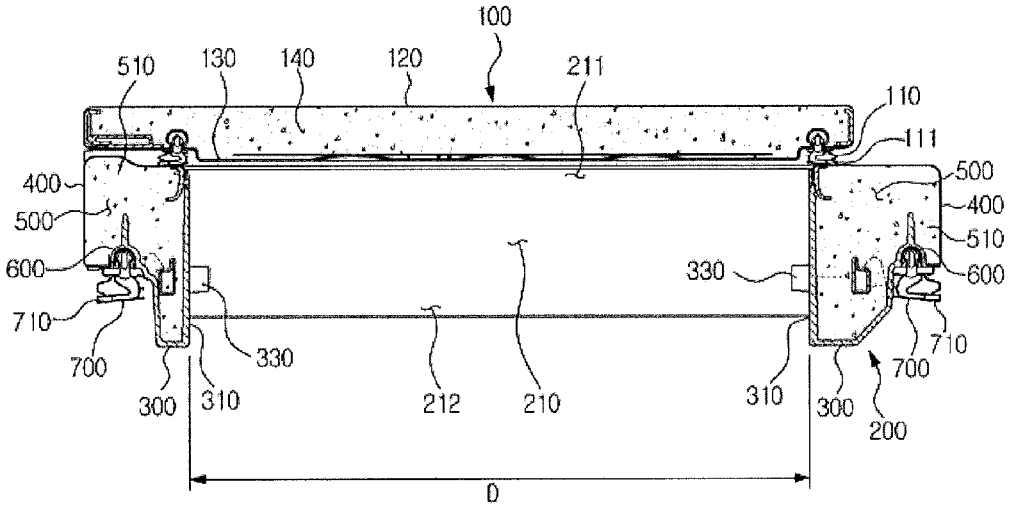


FIG. 6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310
212
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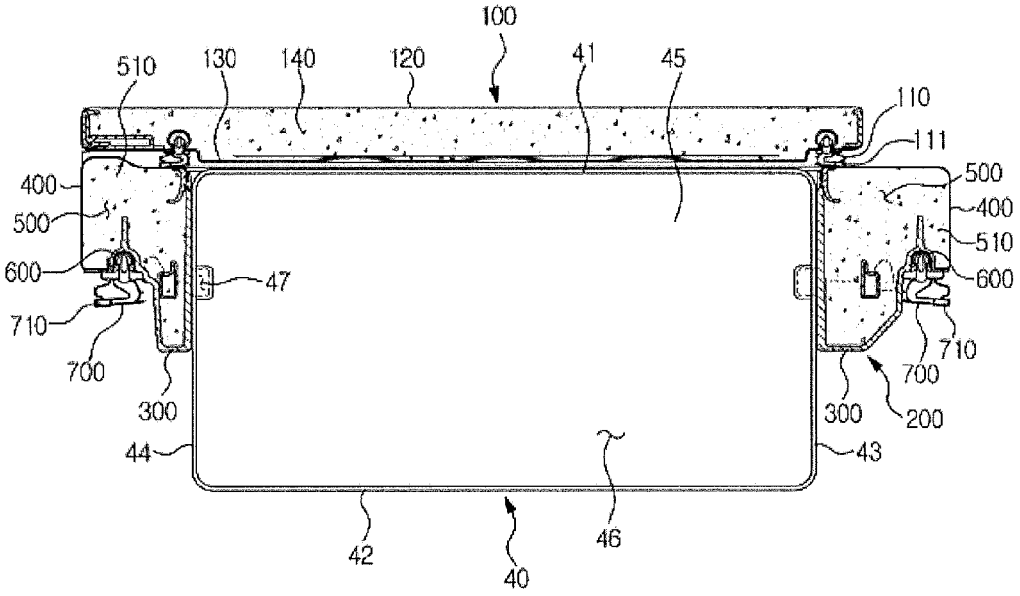
200
D

FIG. 7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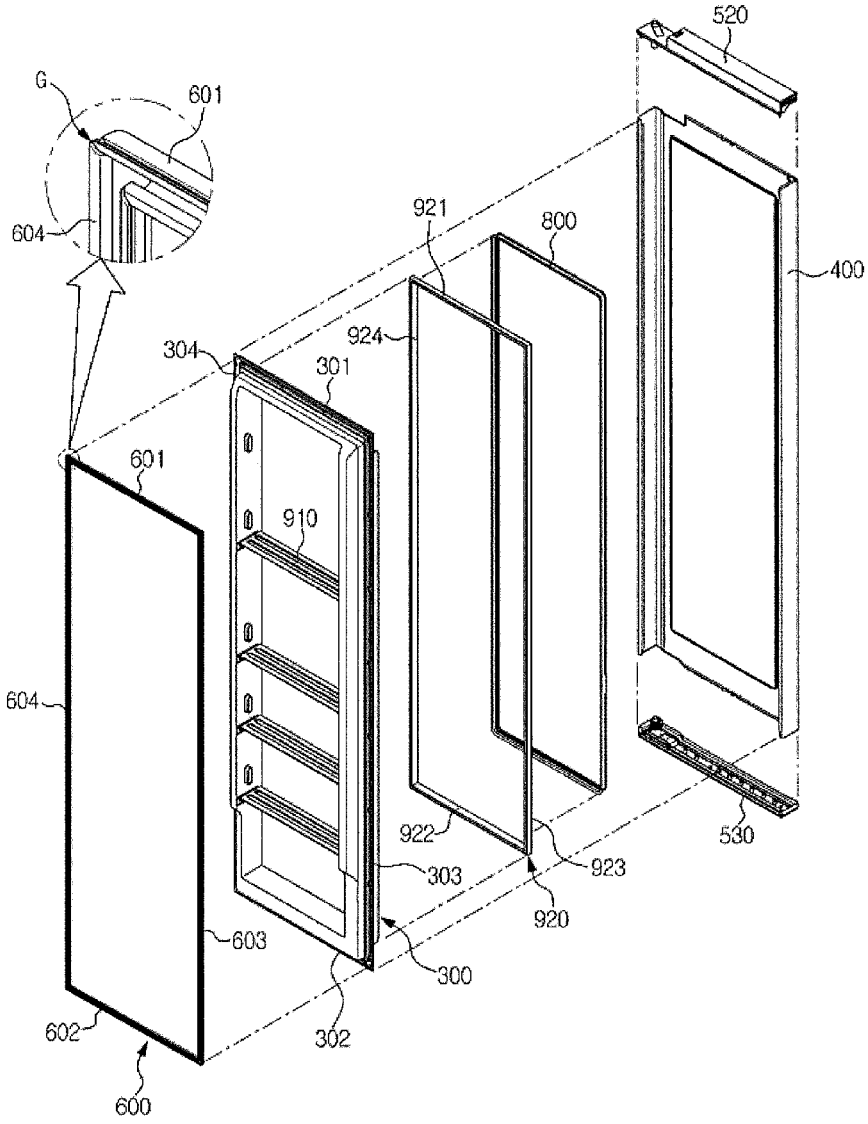
200

FIG. 8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300
602
302
600

FIG. 9

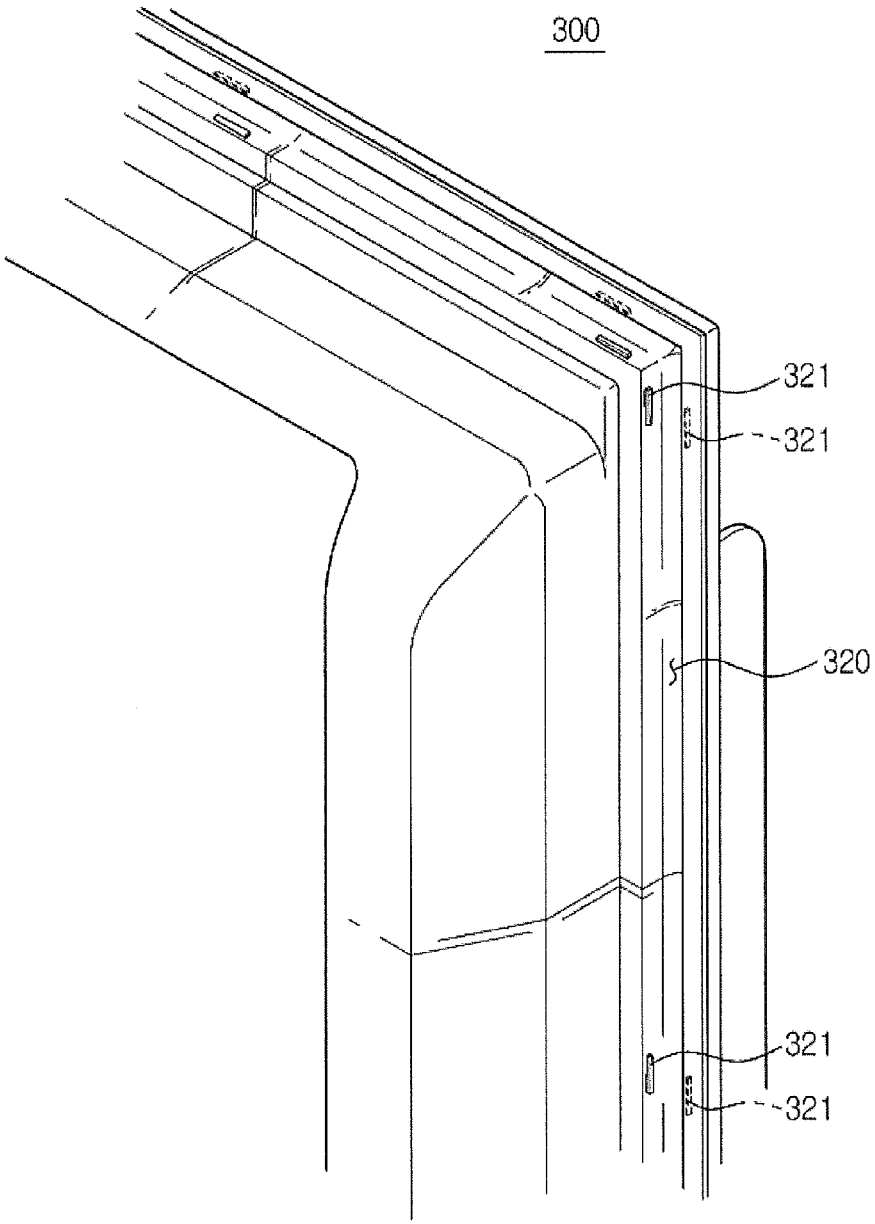


FIG. 10

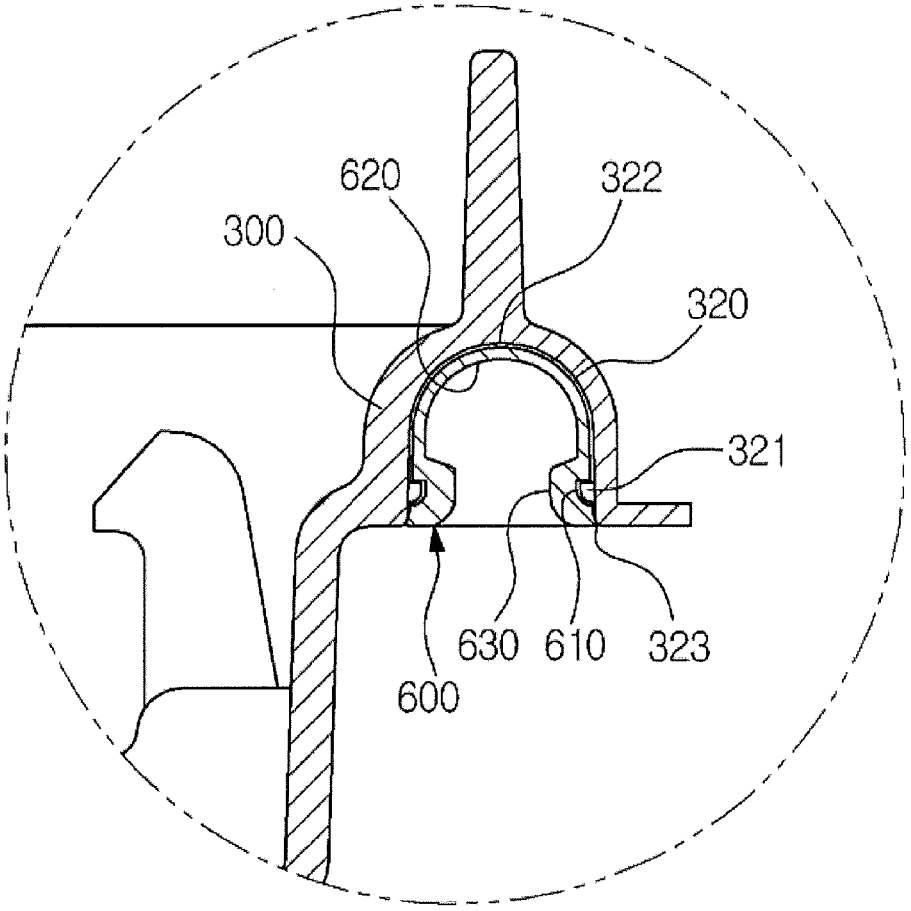
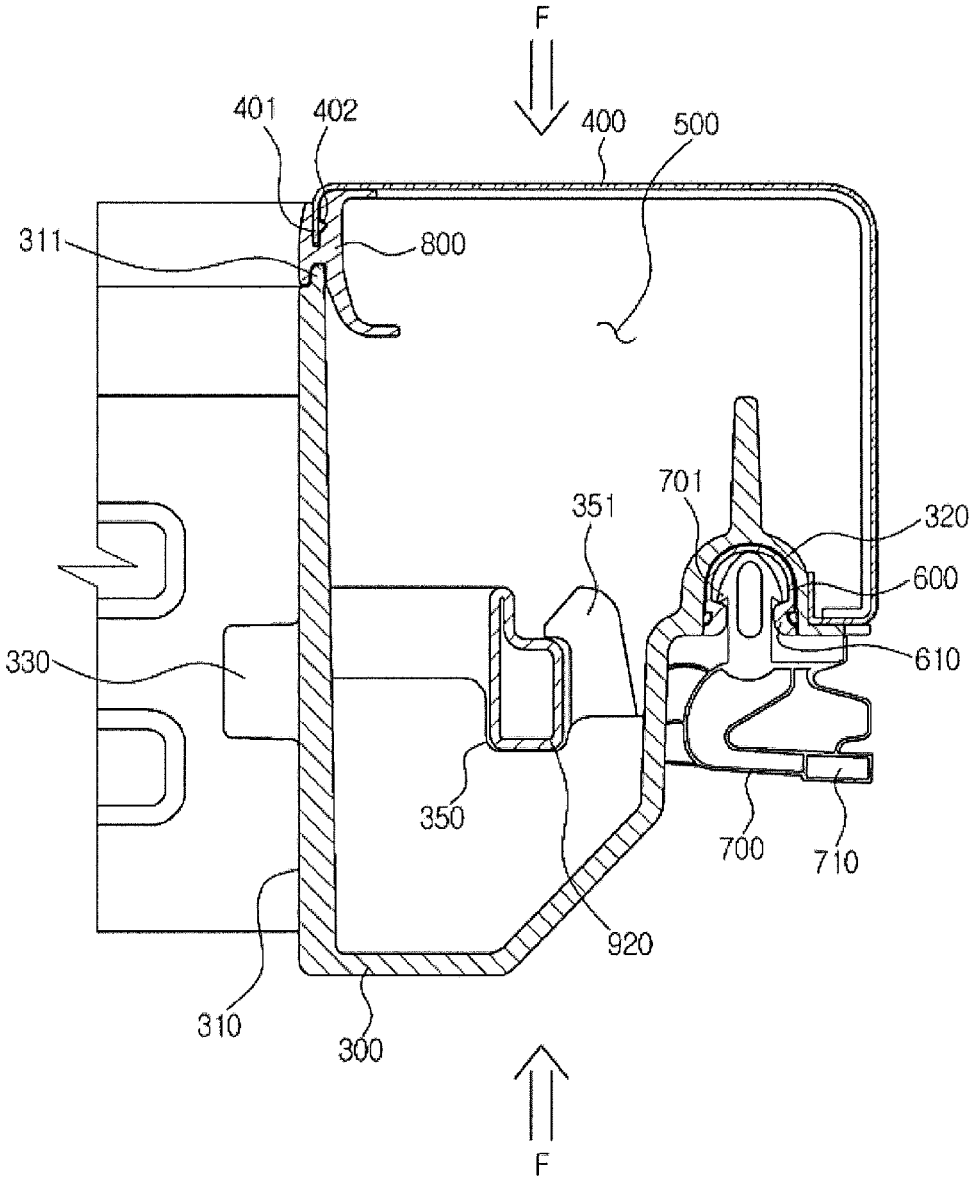


FIG. 11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330
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700
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310
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FIG. 12

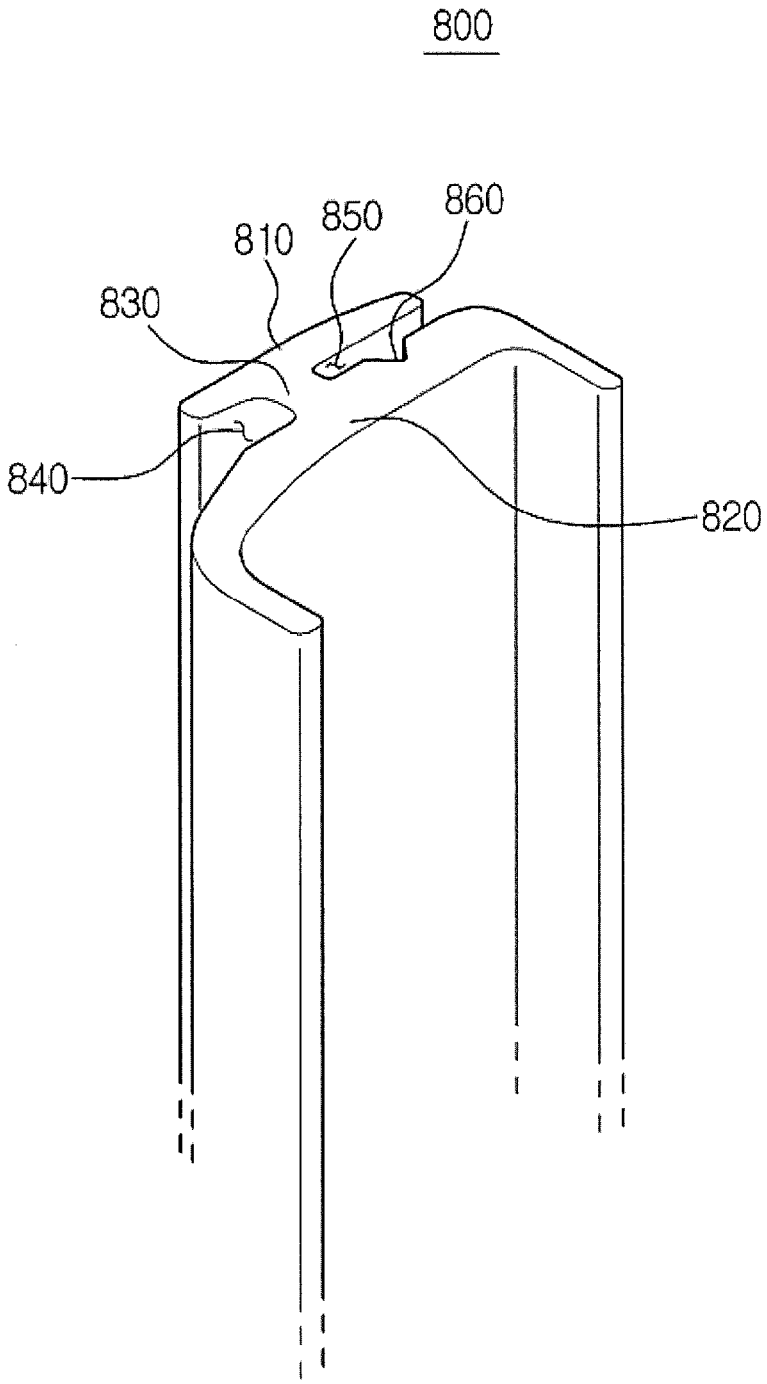
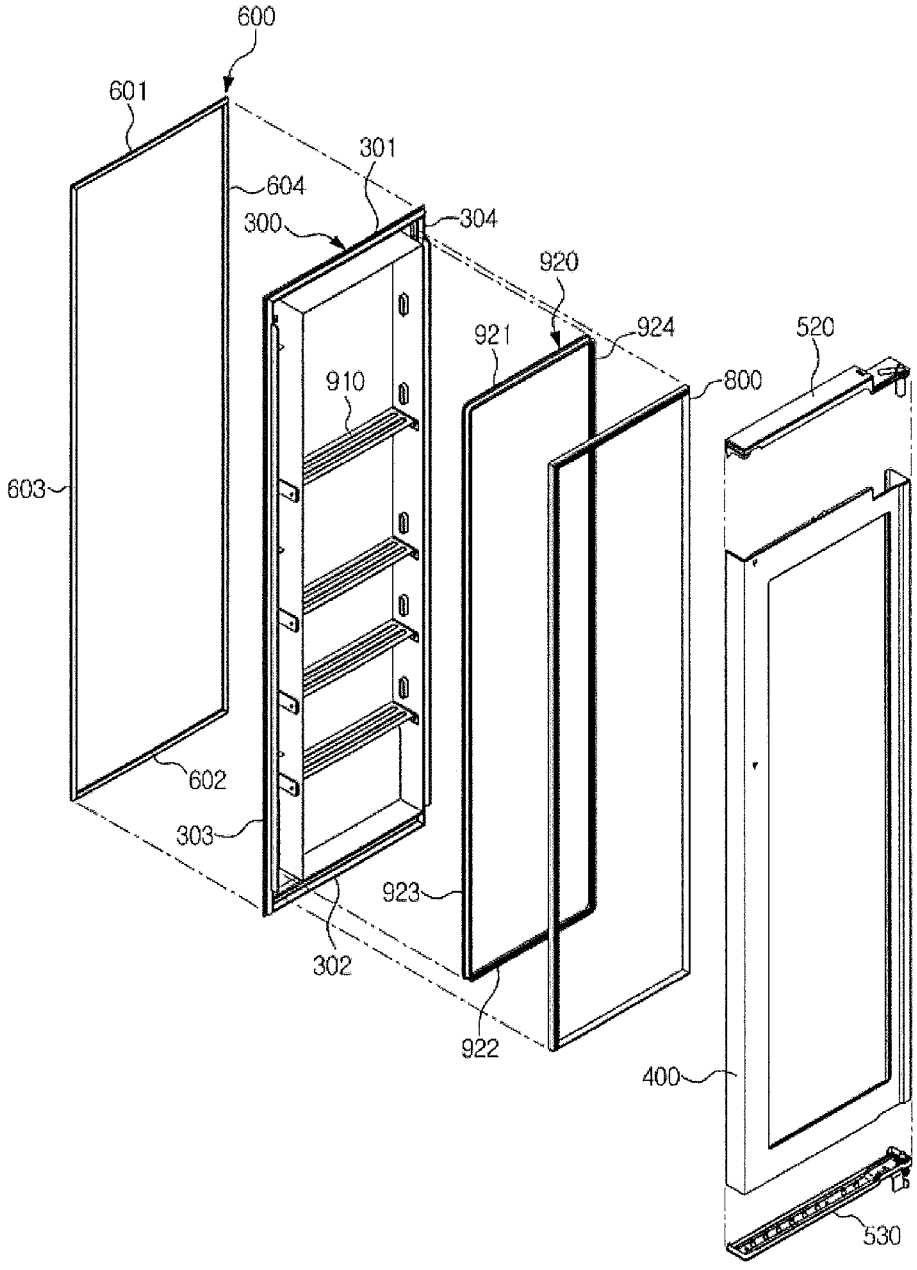


FIG. 13


600
601
301
604
300
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920
921
924
520
910
800
603
602
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923
302
922
400
530

FIG. 14

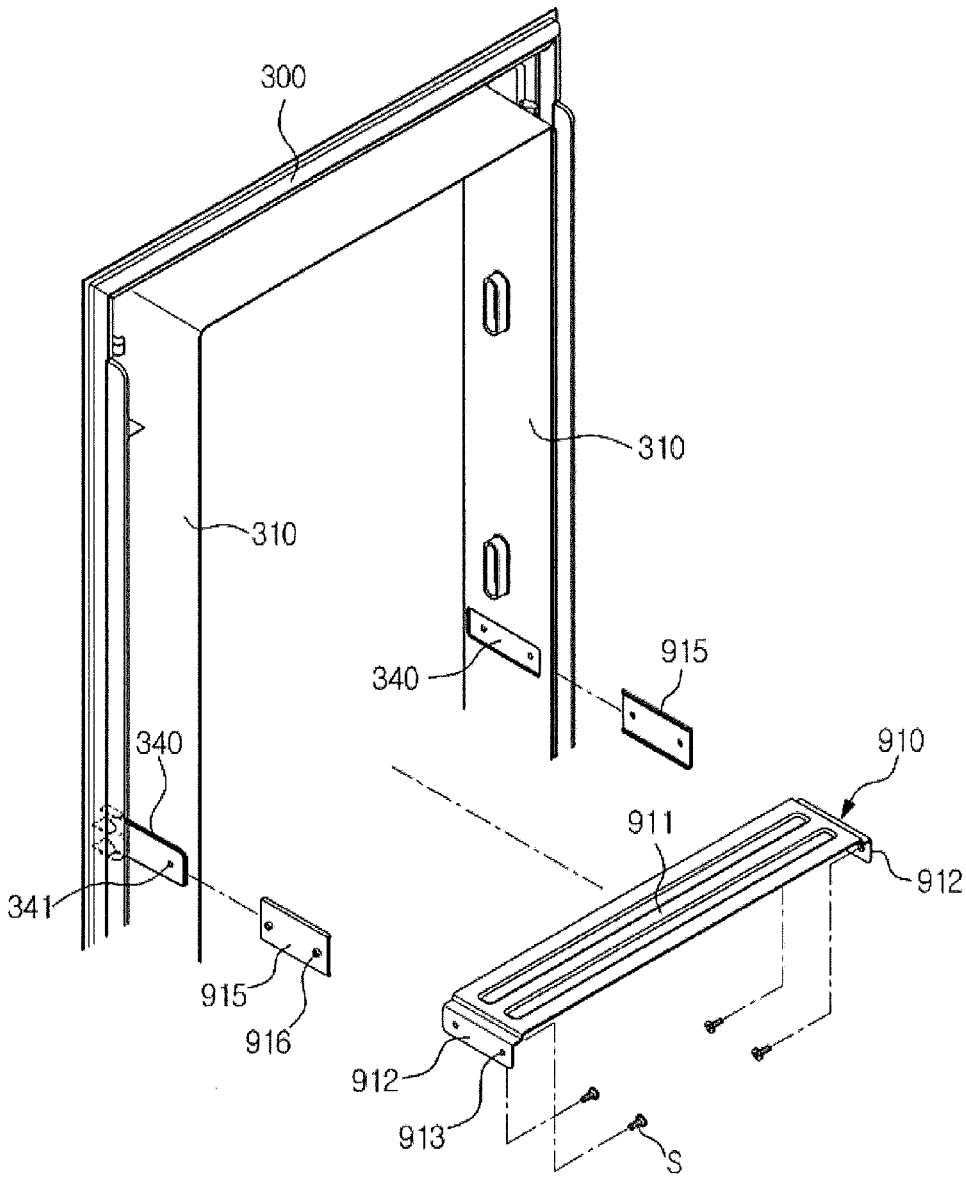
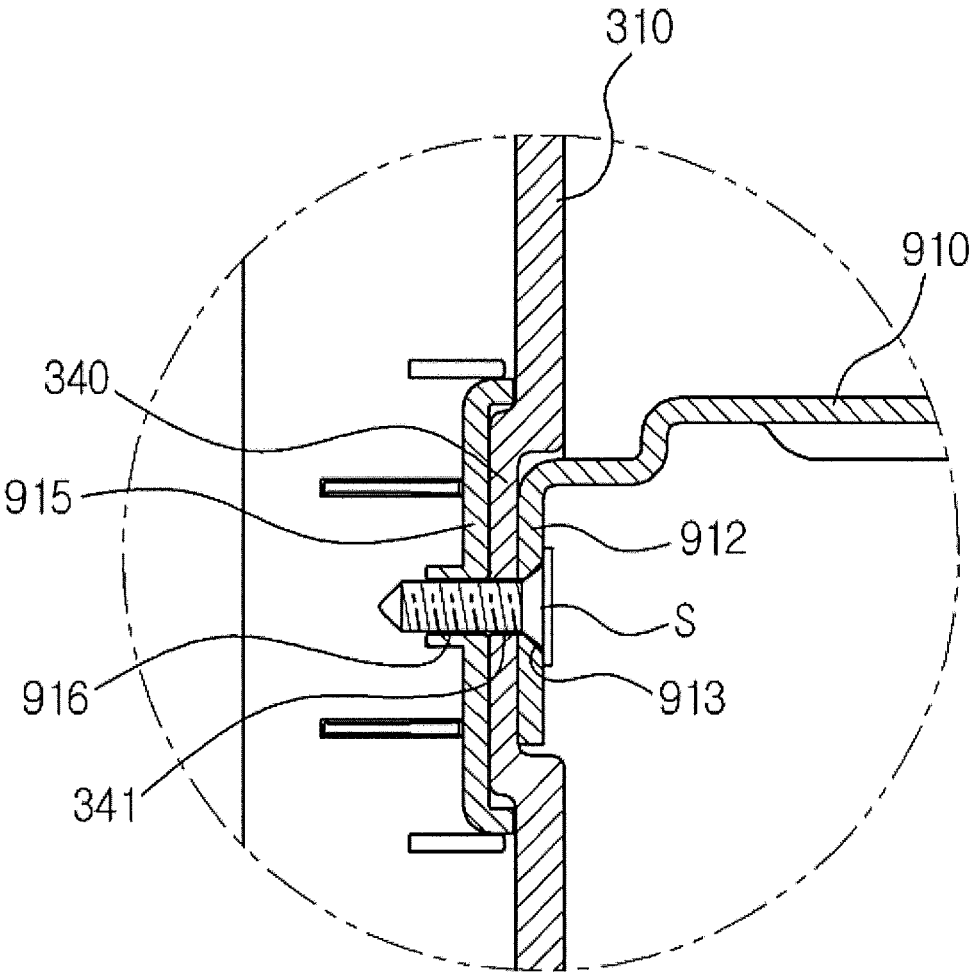


FIG. 15



REFRIGERATOR AND METHOD OF MANUFACTURING INNER DOOR THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Patent Application No. 10-2012-0126894, filed on Nov. 9, 2012, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

1. Field

Embodiments of the present disclosure relate to a refrigerator provided with an inner door having an opening, a door guard provided at the opening and an outer door to open and close the opening.

2. Description of the Related Art

In general, a refrigerator is a household appliance having a storage compartment to store foods, and a cool air supplying apparatus to supply cool air to the storage compartment to keep the foods in a fresh state for a long period of time.

The storage compartment is provided with a rack on which food are placed. The storage compartment has a front surface thereof open such that food is put in or taken out of, and the open front surface of the storage compartment is open and closed by a main door that is rotatably coupled to a body of the refrigerator. A door guard is provided at a rear surface of the main door to store food in addition to the rack disposed in the storage compartment.

Since the door guard is provided at the rear surface of the main door, an access to the door guard is achieved by opening the main door. Meanwhile, another type of refrigerator is provided with a subsidiary door formed on a main door to enable access to a door guard without opening the main door. Such a refrigerator having a subsidiary door enables access to a door guard provided at a rear surface of the door by only opening the subsidiary door without opening the door, so that the food keeping is diversified and cool air is retained.

However, since the subsidiary door has a size limitation, access is made only to some of a plurality of door guards that are provided at the rear surface of the main door one above the other.

SUMMARY

Therefore, it is an aspect of the present disclosure to provide a refrigerator ensuring an access to all of a plurality of door guards provided at a main door by opening only a subsidiary door without opening the main door, and a manufacturing method thereof.

Additional aspects of the disclosure will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the disclosure.

In accordance with one aspect of the present disclosure, a refrigerator includes a body, a storage compartment, an inner door, a plurality of door guards, an outer door, at least one first reinforcing member and a second reinforcing member. The storage compartment may be formed at an inside of the body. The inner door may include an opening corresponding to the storage compartment, an inner panel having an upper side frame, a lower side frame, a left side frame and a right side frame, and an outer panel coupled to the inner panel, the inner door rotatably coupled to the body. The plurality of door guards may be provided at the opening. The outer door may

be rotatably coupled to the body to open and close the opening. The at least one first reinforcing member may be configured to connect the left side frame to the right side frame while traversing the opening. The second reinforcing member may be provided at the upper side frame, the lower side frame, the left side frame and the right side frame.

The inner panel may include one pair of inside walls that support the door guard while forming the opening. The first reinforcing member may be fastened to the inside wall through a fastening member.

The inside wall may be formed to be flat from an entry of the opening to an exit of the opening, and a distance between the one pair of inside walls from the entry of the opening to the exit of the opening may be constant.

The first reinforcing member may include a connection part traversing the opening, and one pair of coupling parts coming into close contact with the one pair of inside walls by being bent from both ends of the connection part.

The refrigerator may further include an attachment panel that is provided at an opposite side of the first reinforcing member with respect to the inside wall to increase a fastening force of the fastening member such that the attachment panel is fastened to the first reinforcing member and the inside wall.

The fastening member may be a screw.

The second reinforcing member may be provided at an inner space formed by the inner panel and the outer panel.

The inner panel may be provided with an accommodation space to accommodate the second reinforcing member and with a hook part to fix the second reinforcing member.

The second reinforcing member may be integrally formed of an upper side reinforcing part, a lower side reinforcing part, a left side reinforcing part and a right side reinforcing part in a shape of a rectangular frame.

The second reinforcing member may be fixed to the inner panel before a blowing agent is foamed between the inner panel and the outer panel.

In accordance with another aspect of the present disclosure, a refrigerator includes a body, a storage compartment, an inner door, a plurality of door guards, an outer door, and at least one reinforcing member. The storage compartment may be formed at an inside of the body. The inner door may include an opening corresponding to the storage compartment, an inner panel having an upper side frame, a lower side frame, a left side frame and a right side frame, and an outer panel coupled to the inner panel, the inner door being rotatably coupled to the body. The plurality of door guards may be provided at the opening. The outer door may be rotatably coupled to the body to open and close the opening. The at least one reinforcing member may be configured to connect the left side frame to the right side frame while traversing the opening to prevent the inner door from being distorted.

The refrigerator may further include a fastening member configured to fasten the reinforcing member to the left side frame and the right side frame.

The refrigerator may further include attachment panels that are provided at the left side frame and the right side frame to increase a fastening force of the fastening member.

In accordance with another aspect of the present disclosure, a refrigerator includes a body, a storage compartment, an inner door, a plurality of door guards, an outer door, and a reinforcing member. The storage compartment may be formed at an inside of the body. The inner door may include an opening corresponding to the storage compartment, an inner panel having an upper side frame, a lower side frame, a left side frame and a right side frame, and an outer panel coupled to the inner panel, the inner door rotatably coupled to the body. The plurality of door guards may be provided at the

opening. The outer door may be rotatably coupled to the body to open and close the opening. The reinforcing member may be provided at the upper side frame, the lower side frame, the left side frame and the right side frame to prevent the inner door from being distorted.

The reinforcing member may be integrally formed of an upper side reinforcing part, a lower side reinforcing part, a left side reinforcing part and a right side reinforcing part.

The inner panel may be provided with an accommodation space to accommodate the reinforcing member and with a hook part to fix the reinforcing member.

As is apparent from the above description, an inner door having an opening is prevented from being distorted.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects of the disclosure will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. **1** is a drawing illustrating a refrigerator in accordance with an embodiment of the present disclosure, in a state of an inner door and an outer door being closed.

FIG. **2** is a drawing illustrating the refrigerator of FIG. **1**, in a state of the inner door and the outer door being separately open.

FIG. **3** is a drawing illustrating the refrigerator of FIG. **1**, in a state of only the inner door being open.

FIG. **4** is a drawing illustrating the refrigerator of FIG. **1**, in a state of the outer door being open.

FIG. **5** is a drawing illustrating the inner door and door guards of the refrigerator of FIG. **1**.

FIG. **6** is a cross sectional view illustrating the inner door and the outer door of the refrigerator of FIG. **1**.

FIG. **7** is a cross sectional view illustrating a state of the door guard being installed on the inner door of the refrigerator of FIG. **1**.

FIG. **8** is an exploded perspective view illustrating the construction of the inner door of the refrigerator of FIG. **1**.

FIG. **9** is a drawing illustrating a portion of an inner panel of the inner door of the refrigerator of FIG. **1**.

FIG. **10** is a cross sectional view illustrating a state of an installation member accommodated in the inner panel of the inner door of the refrigerator of FIG. **1**.

FIG. **11** is a cross sectional view illustrating a portion of the inner door of the refrigerator of FIG. **1**.

FIG. **12** is a drawing illustrating a door trim of the refrigerator of FIG. **1**.

FIG. **13** is an exploded perspective view illustrating the construction of the inner door of the refrigerator of FIG. **1** shown at a different angle.

FIG. **14** is an exploded perspective view illustrating a coupling structure of a first reinforcing member of the refrigerator of FIG. **1**.

FIG. **15** is a cross sectional view illustrating a coupling structure of the first reinforcing member of the refrigerator of FIG. **1**.

DETAILED DESCRIPTION

Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

FIG. **1** is a drawing illustrating a refrigerator in accordance with an embodiment of the present disclosure, in a state of an inner door and an outer door being closed, FIG. **2** is a drawing illustrating the refrigerator of FIG. **1**, in a state of the inner door and the outer door being separately open, FIG. **3** is a drawing illustrating the refrigerator of FIG. **1**, in a state of only the inner door being open, and FIG. **4** is a drawing illustrating the refrigerator of FIG. **1**, in a state of only the outer door being open.

Referring to FIGS. **1** to **4**, a refrigerator **1** in accordance with an embodiment of the present discourse includes a body **10**, storage compartments **20** and **30** provided at an inside the body **10**, and a cool air supply apparatus to supply cool air to the storage compartments **20** and **30**.

The body **10** is provided in an approximate body shape, and includes a inner case **11** forming the storage compartments **20** and **30**, an outer case **12** forming the external appearance of the refrigerator **1** while being coupled to an outside of the inner case **11**, and a heat insulation material provided between the inner case **11** and the outer case **12**. The inner case **11** may be formed of resin, and the outer case **12** may be formed of metal.

The cool air supply apparatus includes a compressor (not shown), a condenser (not shown), an expansion valve (not shown) and an evaporator (not shown) to circulate refrigerant and generate cool air by use of latent heat of evaporation.

The storage compartments **20** and **30** are divided by a middle wall **14** into a freezing compartment **20** on the left side and a refrigerating compartment **30** on the right. However, the position of the freezing compartment **20** and the refrigerating compartment **30** may be interchangeable. The refrigerating compartment **30** is provided with a rack **31** on which foods are placed.

The freezing compartment **20** and the refrigerating compartment **30** have open front surfaces thereof allowing food to be put in or taken out, and the open front surface of the freezing compartment **20** is closed by a freezing compartment door **21**, and the open front surface of the refrigerating compartment **30** is closed by an outer door **100** and an inner door **200**.

The freezing compartment door **21** is rotatably coupled to the body **10** by an upper side hinge member **51** and a lower side hinge member (not shown). The outer door **100** and the inner door **220** are rotatably coupled to the body **10** by an upper side hinge member **52** and a lower side hinge member (not shown).

Although not shown in detail, the outer door **100** and the inner door **200** may have different rotating shafts, or may share a single rotating shaft.

The freezing compartment door **21**, the outer door **100** and the inner door **200** may have a handle **22**, a handle **101** and a handle **201**, respectively.

Meanwhile, the inner door **200** includes an opening **210** having a size substantially corresponding to that of the refrigerating compartment **30**, and a door frame **220** forming the opening **210**. Accordingly, the door frame **220** is provided in a shape of a rectangular frame.

A plurality of door guards **40** are provided at the opening **210** to accommodate foods. The door guards **40** may store foods having a low height and small size or foods that are frequently put in and taken out. The plurality of door guards **40** are aligned at the opening **210** one above the other.

The outer door **100** is provided in the shape of an approximate flat panel having no opening. Accordingly, the outer door **100** is configured to open and close the opening **210** of the inner door **20**.

As for the operational use of the inner door **200** and the outer door **100** in accordance with the embodiment of the present disclosure having the configuration as the above, as shown in FIG. **1**, if the inner door **200** and the outer door **10**

are closed, the refrigerating compartment **30** is sealed and cool air is kept in the refrigerating compartment **30**.

Referring to FIG. **3**, when the outer door **1** is open, a user accesses the plurality of door guards **40** to put in or take out foods at the plurality of door guards **40**. At this time, the cool air leakage of the refrigerating compartment **30** is restricted when compared to a state of the inner door **200** being open.

Referring to FIG. **4**, when the inner door **200** is open, the user accesses the inside of the refrigerating compartment **30** to put in or take out foods stored in the rack **31**. At this time, the user may access the plurality of door guards **40** as well, to put in or take out foods at the plurality of door guards **40**.

As described above, the refrigerator **1** in accordance with the embodiment of the present disclosure enables foods to be put in and taken out in various methods according to user's demand, and also minimizing cool air from leaking since only the outer door **100** is open when the foods stored in the plurality of door guards **40** are put in or taken out.

Further, the refrigerator **1** in accordance with the embodiment of the present disclosure has an enlarged storage space when compared to a conventional refrigerator, thereby enhancing the diversity of food keeping while prevention cool air leakage.

Hereinafter, the inner door **200**, the outer door **100** and the door guard **40** of the refrigerator **1** in accordance with the embodiment of the present disclosure will be described in detail.

FIG. **5** is a drawing illustrating the inner door and a door guard of the refrigerator of FIG. **1**, FIG. **6** is a cross sectional view illustrating the inner door and the outer door of the refrigerator of FIG. **1**, FIG. **7** is a cross sectional view illustrating a state of the door guard being installed on the inner door of the refrigerator of FIG. **1**, FIG. **8** is an exploded perspective view illustrating construction of the inner door of the refrigerator of FIG. **1**, FIG. **9** is a drawing illustrating a portion of an inner panel of the inner door of the refrigerator of FIG. **1**, FIG. **10** is a cross sectional view illustrating a state of an installation member accommodated in the inner panel of the inner door of the refrigerator of FIG. **1**, FIG. **11** is a cross sectional view illustrating a portion of the inner door of the refrigerator of FIG. **1**, and FIG. **12** is a drawing illustrating a door trim of the refrigerator of FIG. **1**.

Referring to FIG. **5**, the door guard **40** is provided in an approximate box shape. Accordingly, the door guard **40** has a front side wall **41**, a rear side wall **42**, a left side wall **43**, a right side wall **44**, a bottom side wall **45** and a storage space **46** to store foods. The left side wall **43** and the right side wall **44** of the door guard **40** may be provided with support grooves **47**, respectively.

The inner door **200** includes inside walls **310** provided at both sides of the opening **210** to support the door guard **40**, and the inside wall **310** is provided with a support protrusion **330** inserted into the support grooves **47** of the door guard **40**.

As the support protrusion **330** is inserted into the support groove **47**, the door guard **40** is mounted on the opening **210**. The door guard **40** may be separated from the opening **21**, and although not shown, the door guard **40** may be provided so as to be slidable in a front and rear side direction or a upper and lower side direction.

Referring to FIG. **8**, the inner door **200** includes an inner panel **300**, an outer panel **400** coupled to the inner panel **300** and allowing a foaming space (**500** in FIG. **6**) to be formed between the inner panel **300** and the outer panel **400**, a plurality of installation members **600** coupled to a rear surface of the inner panel **300** and allowing a gasket (**700** in FIG. **6**) to be installed thereon, a plurality of reinforcing members **910** and **920** to prevent the inner door **200** from being distorted, and a door trim **800** coupled to between an end portion of the inner panel **300** and an end portion of the outer panel **300** to prevent blowing agent foamed in the foaming space **500** from leaking to the outside.

The inner panel **300** includes an upper side frame **301**, a lower side frame **302**, a left side frame **303** and a right side frame **304**, and may be formed of resin as an integrated part through injection molding. The outer panel **400** may be formed of metal.

Referring to FIG. **6**, the inner panel **300** includes one pair of inside walls **310** provided at both sides of the opening **210**. The inside wall **310** may support the door guards (**40** in FIG. **7**) while forming the opening **210**.

In this case, the inside wall **310** is formed to be flat from an entry **211** of the opening **210** to an exit **212** of the opening **210** without having a curvature. In addition, a distance D between the one pair of inside walls **310** may be constant from the entry **211** of the opening **210** to the exit **212** of the opening **210**.

Since the inside wall **310** is formed to be flat, the size of the opening **210** is maximized, and in order to flatten the inside wall **310**, the inside wall **310** is formed through injection molding other than vacuum forming.

The vacuum forming is a manufacturing method in which air between a resin sheet and a mold is suctioned such that the sheet is molded in close contact with the mold. The vacuum forming is cost effective when compared to the injection molding and ensures easy manufacturing, but has a difficulty in forming a flat surface perpendicular to a mold since the sheet needs to come into close contact with the mold.

Referring to FIG. **7**, the door guard **40** has the front side wall **41** disposed so as to make contact with the entry **211** of the opening **210** to form a portion of a front surface of the inner door **200**, and the front side wall **41** of the door guard **40** is completely exposed without being blocked by the inner door **200**.

Through such a configuration, the door guard **40** takes all area of the opening **210**, and the size of the door guard **40** is maximized. In addition, when the door guard **40** is viewed from outside the inner door **200**, the door guard **40** is completely exposed, so that the state of the food stored in the door guard **40** is easily checked.

The door guard **40** of the refrigerator in the embodiment of the present disclosure is provided at the opening **210** of the inner door **20** other than at a rear surface of the outer door **100**.

The outer door **100** includes an outer door inner panel **130**, an outer door outer panel **120**, an insulating material **140** provided between an outer door inner panel **130** and the outer door outer panel **120**, and a gasket **110**.

The outer door inner panel **130** may be formed of resin through a vacuum forming, and the outer door outer panel **120** may be formed of metal. The gasket **110** includes a magnet **111**, and the magnet **111** may interact with the outer panel **400** of the inner door **200**, which is formed of metal.

Meanwhile, the plurality of installation members **600** are configured to enable the gasket **700** to be installed on the inner panel **300** while minimizing the use of a complicated mold, such as a slide core, during an injection molding, and the plurality of installation member **600** are coupled to a rim of a rear surface of the inner panel **300**.

Referring to FIG. **8**, the plurality of installation members **600** include a first installation member **601** coupled to the upper side frame **301** of the inner panel **300**, a second installation member **602** coupled to the lower side frame **302** of the inner panel **300**, a third installation member **603** coupled to

the left side frame **303** of the inner panel **300**, and a fourth installation member **604** coupled to the right side frame **304** of the inner panel **300**.

In the description of the present disclosure, the first installation member **601**, the second installation member **602**, the third installation member **603** and the fourth installation member **604** may be referred to as the installation member **600** as a whole if there is no need to distinguish the respective installation members **601**, **602**, **603** and **604**.

In this case, the first installation member **601**, the second installation member **602**, the third installation member **603** and the fourth installation member **604** are not connected to one other and spaced apart from one another by a predetermined gap G. Accordingly, the first installation member **601**, the second installation member **602**, the third installation member **603** and the fourth installation member **603** are prevented from being interfered with one another due to thermal expansion.

Referring to FIGS. **9** and **10**, the inner panel **300** is provided at the rim of the rear surface thereof with an accommodation groove **320** to accommodate the installation member **600**. The accommodation groove **320** has a cross sectional area increasing from a deepest position **322** thereof to a shallowest position **323** thereof. That is, the accommodation groove **320** may be formed through a general mold instead of a complicated mold, such as a slide core.

A plurality of accommodation protrusions **321** protrude toward the accommodation groove **320** to fix the installation member **600**. The plurality of accommodation protrusions **321** are not formed over the entire area of the accommodation groove **320**, but formed on some area of the accommodation groove **320**. The plurality of accommodation protrusions **321** are formed while being spaced apart from one another.

The installation member **600** includes an installation groove **620** on which the gasket (**700** in FIG. **11**) is installed, an installation protrusion **630** protruding inward of the installation groove **620** to fix the gasket **700** including a magnet **710**, and an insertion groove **610** into which the accommodation protrusion **321** of the inner panel **300** is inserted.

As the installation protrusion **630** is interfered with a fixing protrusion (**701** in FIG. **11**) of the gasket **700**, the gasket **700** is fixed. The installation groove **620** and the installation protrusion **630** of the installation member **600** are integrally formed with each other through an extrusion molding.

According to the refrigerator **1** of the embodiment of the present disclosure, the installation member **600** is inserted into the accommodation groove **320** formed in the inner panel **300** of the inner door **200**, and the gasket **700** is inserted into the installation groove **620** formed in the installation member **600**, thereby installing the gasket **700** on the inner panel **300**. In this process, the inner panel **300** is injection molded through a simple mold, and the installation member **600** is formed through an extrusion molding.

Meanwhile, the door trim **800** is provided to prevent blowing agent in the foaming space **500** between the inner panel **300** and the outer panel **400** from leaking to the outside, and referring to FIGS. **11** and **12**, the door trim **800** includes a first insertion groove **840** with which an end portion **311** of the inside wall **310** of the inner panel **300** comes into close contact, and a second insertion groove **850** with which an end portion **401** of the outer panel **400** comes into close contact.

In addition, the door trim **800** includes a first support part **810** to support the inner panel **300** and the outer panel **400** from outside, a second support part **820** to support the inner panel **300** and the outer panel **400** from inside, and a connection part **830** connecting the first support part **810** to the second support part **820**.

The second support part **820** may be provided with a coupling groove **860**, into which a coupling protrusion **402** of the outer panel **400** is inserted, to increase the coupling strength of the door trim **800** and the outer panel **400**.

A foaming process of the inner door **300** including the door trim **800** is as follows.

First, the inner panel **300**, the outer panel **400** and the door trim **800** are preliminarily coupled to one other, and while having the inner panel **300** placed to face the bottom and the outer panel **400** placed to face the top, the inner panel **300** and the outer panel **400** are pressed in an upper side and lower side direction F by use of a fixing jig (not shown).

Thereafter, blowing agent is injected between the foaming space **500** formed between the inner panel **300** and the outer panel **400** to be foamed. At this time, since the inner panel **300** and the outer panel **400** are being pressed in the upper side and lower side direction, the inner panel **300** and the outer panel **400** are prevented from being separated from each other due to a foaming pressure in a upper side and lower side direction, thereby preventing a blowing agent from leaking in a upper side and lower side direction.

In addition, since the door trim **800** firmly holds the end portion **311** of the inner panel **300** and the end portion **402** of the outer panel **400**, the inner panel **300** and the outer panel **400** are prevented from being separated from each other by a foaming pressure in a left side and right side direction, thereby preventing a blowing agent from leaking.

Without the door trim **800**, even if portions of the inner panel **300** and the outer panel **400**, which are adjacent to the opening, may be overlapped, the inner panel **300** and the outer panel **400** are separated from each other by a foaming pressure and thus blowing agent may leak.

As the foaming of the blowing agent in the foaming space **500** is completed, the inner panel **300**, the outer panel **400** and the door trim **800** may be firmly coupled to one another by the adhesive force of the blowing agent.

Meanwhile, the inner door **200** of the refrigerator **1** in accordance with the aspect of the present disclosure, which has the opening **210**, is vulnerable to distortion. In addition, the inner door **200** may be distorted due to the foaming pressure during the foaming process of the inner door **20**, or may have a difficulty in forming the inside wall **310** to be flat. In order to resolve such a shortcoming, the plurality of reinforcing members (**910** and **920** in FIG. **8**) may be provided in the inner door **200**.

The plurality of reinforcing members **910** and **920** include a first reinforcing member **910** connecting the left side frame **303** of the inner panel **300** to the right side frame **304** of the inner panel **300** while traversing the opening **210**, and a second reinforcing member **920** provided at the upper side frame **301** of the inner panel **300**, the lower side frame **302** of the inner panel **300**, the left side frame **303** of the inner panel **300** and the right side frame **304** of the inner panel **300**.

The first reinforcing member **910** is to be described later. As for the configuration of the second reinforcing member **920**, the second reinforcing member **920** includes an upper side reinforcing part **921**, a lower side reinforcing part **922**, a left side reinforcing part **923** and a right side reinforcing part **924**, and provided in a shape of an approximate rectangular frame. The second reinforcing member **920** is integrally formed of metal having rigidity.

Referring to FIG. **11**, the inner panel **300** is provided with an accommodation space **350** to accommodate the second reinforcing member **920**, and a hook part **351** to fix the second reinforcing member **920**. Accordingly, the second reinforcing member **920** is coupled to the inner panel **300**, and disposed

between the inner panel **300** and the outer panel **400**. Accordingly, the second reinforcing member **920** is not exposed to the outside.

The second reinforcing member **920** is fixed to the inner panel **300** before the blowing agent is foamed in the foaming space **500** between the inner panel **300** and the outer panel **400**.

FIG. **13** is an exploded perspective view illustrating construction of the inner door of the refrigerator of FIG. **1** at a different angle, FIG. **14** is an exploded perspective view illustrating a coupling structure of a first reinforcing member of the refrigerator of FIG. **1**, and FIG. **15** is a cross sectional view illustrating a coupling structure of the first reinforcing member of the refrigerator of FIG. **1**.

Referring to FIGS. **13** and **15**, the first reinforcing member **910** is fastened to the inside wall **310** of the inner panel **300** through a fastening member S. The fastening member may be a screw. A depression part **340** may be formed in the inside wall **310** such that the first reinforcing member **910** is coupled to the depression part **340**.

The first reinforcing member **910** includes a connection part **911** traversing the opening **210**, and a coupling part **912** bent from both ends of the connection part **911** and coming into close contact with the depression part **340**.

The coupling part **912** has a fastening hole **913** allowing the fastening member S to pass therethrough, and the depression part **340** of the inside wall **310** has a fastening hole **341** allowing the fastening member S to pass therethrough.

In addition, an attachment panel **915** having a fastening hole **916** may be coupled at an opposite side of the first reinforcing member **910** with respect to the inside wall **310** to increase the fastening strength of the fastening member S. Accordingly, the fastening member S may sequentially pass through the first reinforcing member **910**, the inside wall **310** and the attachment panel **915**.

As described above, the first reinforcing member **910** directly connects the left side frame **303** and the right side frame **304** of the inner panel **300** to each other, which have relatively large lengths, by traversing the opening **210** so as to prevent the inner door **200** from being distorted. The second reinforcing member **920** is provided at the upper side frame **301** of the inner panel **300**, the lower side frame **302** of the inner panel **300**, the left side frame **303** of the inner panel **300** and the right side frame **304** of the inner panel **300** to reinforce four sides of the inner panel **300**, thereby preventing the door **200** from being distorted.

In accordance with the embodiment of the present disclosure, both of the first reinforcing member **910** and the second reinforcing member **920** are provided, but one of the first reinforcing member **910** and the second reinforcing member **920** may be provided as needed.

Although a few embodiments of the present disclosure have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A refrigerator comprising:

a body;

a storage compartment formed at an inside of the body;

an inner door comprising an opening corresponding to the storage compartment, an inner panel having an upper side frame, a lower side frame, a left side frame and a right side frame, and an outer panel coupled to the inner panel, the inner door rotatably coupled to the body;

a plurality of door guards provided at the opening;

an outer door rotatably coupled to the body to open and close the opening;

at least one first reinforcing member configured to connect the left side frame to the right side frame while traversing the opening; and

a second reinforcing member provided at the upper side frame, the lower side frame, the left side frame and the right side frame.

2. The refrigerator of claim **1**, wherein the inner panel comprises one pair of inside walls that support the plurality of door guards while forming the opening, and

the at least one first reinforcing member is fastened to the pair of inside walls through a fastening member.

3. The refrigerator of claim **2**, wherein the pair of inside walls are formed to be flat from an entry of the opening to an exit of the opening, and a distance between the one pair of inside walls from the entry of the opening to the exit of the opening is constant.

4. The refrigerator of claim **2**, wherein the at least one first reinforcing member comprises a connection part traversing the opening, and one pair of coupling parts coming into close contact with the one pair of inside walls by being bent from both ends of the connection part.

5. The refrigerator of claim **2**, further comprising an attachment panel that is provided at an opposite side of the at least one first reinforcing member with respect to the pair of inside walls to increase a fastening force of the fastening member such that the attachment panel is fastened to the at least one first reinforcing member and the pair of inside walls.

6. The refrigerator of claim **2**, wherein the fastening member is a screw.

7. The refrigerator of claim **1**, wherein the second reinforcing member is provided at an inner space formed by the inner panel and the outer panel.

8. The refrigerator of claim **1**, wherein the inner panel is provided with an accommodation space to accommodate the second reinforcing member and with a hook part to fix the second reinforcing member.

9. The refrigerator of claim **8**, wherein the second reinforcing member is fixed to the inner panel before blowing agent is foamed between the inner panel and the outer panel.

10. The refrigerator of claim **1**, wherein the second reinforcing member is integrally formed of an upper side reinforcing part, a lower side reinforcing part, a left side reinforcing part and a right side reinforcing part in a shape of a rectangular frame.

11. A refrigerator comprising:

a body;

a storage compartment formed at an inside of the body;

an inner door comprising an opening corresponding to the storage compartment, an inner panel having an upper side frame, a lower side frame, a left side frame and a right side frame, and an outer panel coupled to the inner panel, the inner door rotatably coupled to the body;

a plurality of door guards provided at the opening;

an outer door rotatably coupled to the body to open and close the opening;

at least one reinforcing member configured to connect the left side frame to the right side frame while traversing the opening to prevent the inner door from being distorted;

a fastening member configured to fasten the at least one reinforcing member to the left side frame and the right side frame; and

attachment panels that are provided at the left side frame and the right side frame to increase a fastening force of the fastening member.

12. A refrigerator comprising:
a body;
a storage compartment formed at an inside of the body;
an inner door comprising an opening corresponding to the storage compartment, an inner panel having an upper side frame, a lower side frame, a left side frame and a right side frame, and an outer panel coupled to the inner panel, the inner door rotatably coupled to the body;
a plurality of door guards provided at the opening;
an outer door rotatably coupled to the body to open and close the opening; and
a reinforcing member provided at the upper side frame, the lower side frame, the left side frame and the right side frame to prevent the inner door from being distorted.

13. The refrigerator of claim 12, wherein the reinforcing member is integrally formed of an upper side reinforcing part, a lower side reinforcing part, a left side reinforcing part and a right side reinforcing part.

14. The refrigerator of claim 13, wherein the inner panel is provided with an accommodation space to accommodate the reinforcing member and with a hook part to fix the reinforcing member.

15. The refrigerator of claim 12, further comprising a plurality of installation members, the plurality of installation members including a first installation member coupled to the upper side frame, a second installation member coupled to the lower side frame, a third installation member coupled to the left side frame, and a fourth installation member coupled to the right side frame,

wherein each of the plurality of installation members include an installation groove configured to receive a gasket and an installation protrusion protruding inward of the installation groove to fix the gasket.

16. The refrigerator of claim 15, wherein the first installation member, the second installation member, the third installation member and the fourth installation member are not connected to one other and are spaced apart from one another by a predetermined gap.

17. The refrigerator of claim 15, wherein the inner panel is provided at a rim of a rear surface thereof with an accommodation groove to accommodate the plurality of installation members.

18. The refrigerator of claim 17, wherein the accommodation groove has a cross sectional area increasing from a deepest position thereof to a shallowest position thereof.

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